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AVIATION TERMINAL FORECASTS (D-31)

Examples showing combinations of more than one type of precipitation:

-RASN FG HZ light rain and snow (light rain predominant), fog, and haze

TSSNRA thunderstorm with moderate snow and rain (moderate snow predominant)

* FZRASNPL moderate freezing rain, snow, and ice pellets
(freezing rain mentioned first due to the descriptor, followed by other precipitation types in order of predominance)

* SHPLSN moderate ice pellet and snow showers

Example:

TAF

KFAR 091739Z 091818 21030G60KT 1/4SM +TSRAGR BKN050CB etc.=

Scheduled terminal forecast for Hector International Airport, issued at 1739 UTC on the 9th day of the month, valid from 1800 UTC on the 9th until 1800 UTC the next day (the 10th): Winds from 210 degrees at 30 knots gusting to 60 knots, visibility 1/4 statute mile in thunderstorms with heavy rain and hail. NOTE: the "+" qualifier is associated with the precipitation (RA) and not the thunderstorm ("TS"). Broken cumulonimbus clouds (ceiling) at 5,000 feet.

Thunderstorm (TS) is the only descriptor which may be encoded as a significant weather group without any associated precipitation. TS may be encoded standing alone in a forecast in two situations: 1) when thunderstorm(s) are forecast without associated precipitation, or 2) to indicate thunderstorms with freezing precipitation (drizzle or rain).

Whenever a thunderstorm(s) is included in the significant weather group, even in the vicinity (VCTS), the cloud group (N_sN_sN_sh_sh_sh_s) shall include a forecast cloud type of cumulonimbus (CB).

Example:

TAF

KMCI 252335Z 260024 31015KT 1 1/2SM TS -FZRA BKN010CB etc.=

Scheduled terminal forecast for Kansas City International Airport,

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issued on the 25th day of the month at 2335 UTC, and valid from 0000 UTC on the 26th until 0000 UTC the next day (the 27th): Wind from 310 degrees at 15 knots, visibility 1 ½ statute miles in thunderstorms and light freezing rain, broken cumulonimbus clouds (ceiling) at 1,000 feet.

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A visibility threshold must be met before a forecast for fog (FG) may be included in the terminal forecast. When forecasting a fog-restricted visibility of 5/8SM to 6SM inclusive, the phenomena shall be coded as BR (mist). When forecasting a fog-restricted visibility that is less than 5/8SM, use code FG (fog). Never encode weather/obscuration as mist (BR) when the forecast visibility is greater than 6 statute miles, i.e., P6SM.

The following fog-related terms shall only be used as described below:

freezing fog (FZFG): Any fog (visibility less than 5/8 statute miles) consisting predominantly of water droplets at temperatures *below 0NC, whether or not rime ice is expected to be deposited*. FZBR is not a valid significant weather combination and shall not be used in terminal forecasts.

shallow fog (MIFG): the visibility at 6 feet above ground level shall be 5/8 statute miles or more and the apparent visibility in the fog layer shall be less than 5/8 statute miles.

patchy fog (BCFG): fog patches covering part of the airport. The apparent visibility in the fog patch or bank shall be less than 5/8 statute miles, with the foggy patches extending to at least 6 feet above ground level.

partial fog (PRFG): a substantial part of the airport is expected to be covered by fog while the remainder is expected to be clear of fog (e.g., a fog bank).

NOTE: shallow fog (MIFG), partial fog (PRFG), and patchy fog (BCFG) may be forecast with prevailing visibility of 7 statute miles or greater.

Examples:

TAF

KLWS 020530Z 020606 27010KT 1/2SM FG VV010 BECMG 1011 3SM
BR BKN010 etc.=

This example, for Lewiston-Nez Perce County Airport, shows the proper use of FG (fog) and BR (mist), depending on the associated visibility. Scheduled terminal forecast for Nez Perce County Regional Airport,

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issued at 0530 UTC on the 2nd day of the month, valid from 0600 UTC on the 2nd until 0600 UTC the next day (the 3rd): Wind from 270 degrees at 10 knots, visibility $\frac{1}{2}$ statute mile in fog, vertical visibility 1,000 feet into a surface-based obscuration (ceiling). Change between 1000 and 1100 UTC to visibility 3 statute miles in mist, broken clouds (ceiling) at 1,000 feet.

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Examples (continued):

TAF

* KSYR 230532Z 230606 29012KT 1/2SM SHSN FZFG OVC003
TEMPO 0609 29014G28KT 1/4SM +TSSNPL BLSN VV001CB
FM1400 36011KT P6SM FEW008 BKN025 BECMG 2224 VRB03KT
SKC=

* Scheduled terminal forecast for Syracuse Hancock International Airport, issued on the 23rd day of the month at 0532 UTC and valid from 0600 UTC on the 23rd until 0600 UTC the next day (the 24th): Wind from 290 degrees at 12 knots, visibility 1/2 statute mile in moderate snow showers and freezing fog, overcast clouds (ceiling) at 300 feet. Temporarily between 0600 and 0900 UTC, wind from 290 degrees at 14 knots gusting to 28 knots, visibility 1/4 statute mile in a thunderstorm with heavy snow and ice pellets, and blowing snow, vertical visibility 100 feet into a surface-based obscuration (ceiling) composed of cumulonimbus (CB was appended to the vertical visibility due to the presence of thunder). NOTE: the "+" qualifier is associated with the precipitation snow ("SN") and ice pellets ("PL") and **not** the thunderstorm ("TS"). Significant change at 1400 UTC to wind from 360 degrees at 11 knots, visibility greater than 6 statute miles (unrestricted), few clouds at 800 feet. Change between 2200 UTC and 0000 UTC to variable wind direction (here due to light winds), wind speed 3 knots, and clear skies.

7.2.8 Non-Convective Low-Level Wind Shear Group

(WS_h~~WS~~_h~~WS~~_h/dddfKT). Wind shear is defined in NOAA Technical Memorandum NWS FCST-23, "Low-Level Wind Shear: A Critical Review", by Julius Badner, NWS Meteorological Services Division, April 1979, reprinted February 1989, as "...a change in horizontal wind speed, and/or direction, and/or vertical speed with distance measured in a horizontal and/or vertical direction." Wind shear is a **vector difference**, composed of wind direction and wind speed, between two wind velocities. A sufficient difference in wind speed, or wind direction, or both, can have a negative impact on airplanes, especially within 2,000 feet of the ground.

The following paragraph emphasizing the importance of wind shear is taken from ICAO Circular 186-AN/122, entitled Wind Shear, published in 1987:

"Wind shear cannot be calculated by simple scalar subtraction of the wind speeds, except in the specific case where the directions of the two winds concerned are exactly the same or

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are exact reciprocals. ...The scalar shear (i.e. direct subtraction of wind speeds taking no account of their directions) is always less than or equal to the vector shear and thus for most cases underestimates the actual shear magnitude."

Forecasters may use NOAA Technical Memorandum NWS FCST-23, "Low-Level Wind Shear: A Critical Review", as a reference for non-convective low-level wind shear forecasting. The procedures described below are based on that study.

Forecasts of wind shear in the terminal forecast shall refer only to non-convective wind shear up to and including 2,000 feet of the ground and shall be included in terminal forecasts, on an as needed basis, to focus the attention of the pilot on non-convective wind shear problems, existing or expected. Non-convective low-level wind shear may be associated with the following: frontal passage, inversion, low-level jet, lee side of mountain effects, sea breeze front, Santa Ana winds, etc.

Non-convective low-level wind shear forecasts (indicated by WS) shall be included in the terminal forecast, when expected, as the last group (i.e., after the cloud forecast) in the initial forecast period or in a FM group. Once included in the forecast, the wind shear group remains the prevailing condition until the next FM group or the end of the forecast valid period if there are no subsequent FM groups. **Forecasts of non-convective low-level wind shear shall not be included in BECMG (see Section 7.2.9.b), TEMPO (see Section 7.2.9.c), or PROB (see Section 7.2.9.d) groups.**

The format of the non-convective low-level wind shear group is:

$WS h_{WS} h_{WS} / dddffKT$, where:

WS	=	an indicator for non-convective low-level wind shear;
$h_{WS} h_{WS} h_{WS}$	=	height of the wind shear, in hundreds of feet (AGL);
ddd	=	true direction, in multiples of ten degrees, of the wind above the indicated height; see Note below

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ff = speed, in knots, of the forecast wind above the
 indicated height; and
KT = a units indicator, meaning knots

**NOTE: VRB shall not be used in the non-convective low-level
wind shear forecast group.**

CONTRACTIONS USED IN TERMINAL FORECASTS

NOTE: Some of the expressions -- short words, in common English, for which there are no ICAO contractions -- are completely spelled out, e.g., "AND" and "WIND". "TO" and "NIL" are both listed in the ICAO contraction manual. Both are common words in English.

AAx	Code used in the WMO abbreviated heading to indicate an amended forecast, where x is the letter A through X (see Section 7.1). NOTE: AAx is not used in the forecast text.
AFT	After
AGL	Above ground level
AMD	Amended terminal forecast. Used in the forecast text only. AMD is not used in the WMO abbreviated heading.
BC	Patches
BECMG	Becoming. Indicator of a forecast change to prevailing meteorological conditions, occurring at either a regular or irregular rate at an unspecified time within the indicated period of time. The change occurs during the indicated period of time and the indicated conditions persist until the next forecast change indicator. The duration of the change period covered by BECMG, indicated by GGG_eG_e, shall never exceed 2 hours in NWS-prepared terminal forecasts. Refer to Section 7.2.9.b.
BKN	Broken cloud layer (5 to 7 oktas cloud amount). Lowest broken layer is implied to be the ceiling.
BL	Blowing
BR	Mist
CAVOK	Not used in NWS-prepared terminal forecasts. Contraction for "Ceiling and Visibility OK" and pronounced KAV-OH-KAY. Replaces visibility, present weather and cloud data under specified conditions. See Appendix G, Section 1.1, for more specific information.
CB	Cumulonimbus cloud
CCCC	Generic WMO format code group for a four-letter location identifier. Four-letter location identifiers for specific airports are listed in ICAO document 7910, "Location Indicators".

CCx	Code used in the WMO abbreviated heading to indicate a corrected forecast, where x is the letter A through X (see Section 7.1). CCx is not used in the forecast text.
CLD	Cloud
CLR	Not used in the terminal forecast. In the METAR code, CLR indicates "clear below 12,000 feet above ground level" and applies to automated observations only.
DR	Low drifting
DS	Dust storm
DU	Dust
DZ	Drizzle
FC	Funnel cloud
FEW	Few clouds (> 0 oktas to 2 oktas cloud amount)
FG	Fog
FMGGgg	From the time (UTC) indicated by GGgg. Generic WMO format code group, indicating a significant and rapid (in less than one hour) change to a new set of prevailing conditions. Refer to Section 7.2.9.a.
FT	Feet
FU	Smoke
FZ	Freezing
G	Gust. Defined as rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls.
GR	Hail (diameter of largest hailstone $\geq 1/4$ inch)
GS	Small hail and/or snow pellets (diameter of hailstones < 1/4 inch)
HZ	Haze
IC	Ice crystals
KT	Knots
LTD	Limited

MI Shallow

NIL No or None or I have nothing to send you

NSC Contraction for "no significant cloud", which replaces cloud data under specified conditions. See Appendix G, Section 1.2, for more specific information. **Not used in NWS-prepared terminal forecasts.**

NSW A contraction for "no significant weather". An indication that significant weather conditions, as expressed by Appendix I (WMO Code Table 4678), are forecast to end. Refer to Section 7.2.6.

OVC Overcast cloud layer (8 oktas cloud amount)

P Greater than (as in P6SM)

P6SM Visibility forecast to be greater than 6 statute miles

* PL Ice pellets

PO Well-developed dust/sand whirls

SIGNIFICANT WEATHER: WMO CODE TABLE 4678

w'w' CODE TABLE 4678 --Significant present and forecast weather

The w'w' groups shall be constructed by considering columns 1 to 5 in the table above in sequence, that is intensity (if appropriate), followed by the descriptor (if appropriate), followed by weather phenomena. For example, heavy rain shower(s) are coded as +SHRA.

QUALIFIER		WEATHER PHENOMENA		
INTENSITY OR PROXIMITY 1	DESCRIPTOR 2	PRECIPITATION 3	OBSCURATION 4	OTHER 5

—	Light	MI	Shallow	DZ	Drizzle	BR	Mist	PO	Well-developed dust/sand whirls
	Moderate (no qualifier)	BC	Patches	RA	Rain	FG	Fog	SQ	Squalls
+	Heavy (or well-developed, in the case of funnel clouds)	PR	Partial (Covering part of the aerodrome)	SN	Snow	FU	Smoke	FC⁸	Funnel cloud(s) (tornado or waterspout)
		DR	Low drifting	SG	Snow grains	VA	Volcanic ash	SS	Sandstorm
VC⁴	In the vicinity	BL	Blowing	IC	Ice crystals	DU	Widespread dust	DS	Duststorm
		SH	Shower(s)	PL	Ice pellets	SA	Sand		
		TS	Thunderstorm	GR⁵	Hail	HZ	Haze		
		FZ	Freezing	GS⁶	Small hail and/or snow pellets	PY	Spray		
				UP⁷	Unknown precipitation in automated obs				

⁴ The NWS definition of **VC** applied to the terminal forecast is: An area encompassed between circles with radii of 5 and 10 statute miles, respectively, from the center of the airport's runway complex

⁵ diameter of largest hailstone $\geq 1/4$ "

⁶ diameter of hailstones $< 1/4$ "

⁷ UP shall not be used in NWS-prepared terminal forecasts

⁸ Tornadic activity, including tornadoes, waterspouts, and funnel clouds, should not be included in terminal forecasts because the probability of occurrence at a specific site is very small.

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SIGNIFICANT WEATHER PHENOMENA MATRIX FOR NWS-PREPARED TERMINAL FORECASTS

(footnotes on reverse side)

WX PHENOMENA		QUALIFIER											
Precipitation		Intensity or Proximity				Descriptor ¹							
		Light -	Moderate e	Heavy +	Vicinity VC ²	Shallow MI	Partial PR	Patches BC	Low Drifting DR ³	Blowing BL	Shower(s) SH	Thunderstorm TS ⁴	Freezing FZ
Drizzle	DZ	-DZ	DZ	+DZ	-	-	-	-	-	-	-	-	FZDZ
Rain	RA	-RA	RA	+RA	-	-	-	-	-	-	SHRA	TSRA	FZRA
Snow	SN	-SN	SN	+SN	-	-	-	-	DRSN	BLSN	SHSN	TSSN	-
Snow Grains	SG	-SG	SG	+SG	-	-	-	-	-	-	-	-	-
Ice Crystals ⁵	IC	-	IC	-	-	-	-	-	-	-	-	-	-
Ice Pellets	PL	-PL	PL	+PL	-	-	-	-	-	-	SHPL	TSPL	-
Hail ^{5,6}	GR	-	GR	-	-	-	-	-	-	-	SHGR	TSGR	-
Small Hail ^{5,7}	GS	-	GS	-	-	-	-	-	-	-	SHGS	TSGS	-
Thunderstorms, Showers, Freezing, and their Intensity or Proximity							-	-	-	-	-	-	-
TS	-	-	TS	-	VCTS ⁸	-	-	-	-	-	-	-	-
TSRA	-	-TSRA	TSRA	+TSRA	-	-	-	-	-	-	-	-	-
TSSN	-	-TSSN	TSSN	+TSSN	-	-	-	-	-	-	-	-	-
TSPL	-	-TSPL	TSPL	+TSPL	-	-	-	-	-	-	-	-	-
TSGS	-	-	TSGS	-	-	-	-	-	-	-	-	-	-
TSGR	-	-	TSGR	-	-	-	-	-	-	-	-	-	-
SH	-	-	-	-	VCSH ⁹	-	-	-	-	-	-	-	-
SHRA	-	-SHRA	SHRA	+SHRA	-	-	-	-	-	-	-	-	-
SHSN	-	-SHSN	SHSN	+SHSN	-	-	-	-	-	-	-	-	-
SHPL	-	-SHPL	SHPL	+SHPL	-	-	-	-	-	-	-	-	-
SHGR	-	-	SHGR	-	-	-	-	-	-	-	-	-	-
SHGS	-	-	SHGS	-	-	-	-	-	-	-	-	-	-
FZDZ	-	-FZDZ	FZDZ	+FZDZ	-	-	-	-	-	-	-	-	-
FZRA	-	-FZRA	FZRA	+FZRA	-	-	-	-	-	-	-	-	-
FZFG	-	-	FZFG	-	-	-	-	-	-	-	-	-	-
Obscurations		-	-	-	-	-	-	-	-	-	-	-	-
Mist ¹⁰	BR	-	BR ¹⁰	-	-	-	-	-	-	-	-	-	-
Fog ¹¹	FG	-	FG ¹¹	-	VCFG ¹²	MIFG ¹³	PRFG ¹⁴	BCFG ¹⁵	-	-	-	-	FZFG ¹⁶
Smoke	FU	-	FU	-	-	-	-	-	-	-	-	-	-
Volcanic Ash ¹⁷	VA	-	VA ¹⁷	-	-	-	-	-	-	-	-	-	-
Widespread Dust	DU	-	DU	-	-	-	-	-	DRDU	BLDU	-	-	-
Sand	SA	-	SA	-	-	-	-	-	DRSA	BLSA	-	-	-
Haze	HZ	-	HZ	-	-	-	-	-	-	-	-	-	-
Spray	PY	-	-	-	-	-	-	-	-	BLPY	-	-	-
Blowing Phenomena		-	-	-	-	-	-	-	-	-	-	-	-
BLSN ¹⁸	-	-	BLSN	-	-	-	-	-	-	BLSN	-	-	-
BLSA	-	-	BLSA	-	-	-	-	-	-	BLSA	-	-	-
BLDU	-	-	BLDU	-	-	-	-	-	-	BLDU	-	-	-
Other		-	-	-	-	-	-	-	-	-	-	-	-
Sand/Dust Whirls	PO	-	PO	-	-	-	-	-	-	-	-	-	-
Squalls ¹⁹	SQ	-	SQ	-	-	-	-	-	-	-	-	-	-
Funnel Cloud ²⁰	FC	-	FC	-	-	-	-	-	-	-	-	-	-
Tornado/Waterspo	+FC	-	-	+FC	-	-	-	-	-	-	-	-	-
Sandstorm ²²	SS	-	SS	+SS	-	-	-	-	-	-	-	-	-

WX PHENOMENA		QUALIFIER											
Duststorm ²³	DS	-	DS	+DS	-	-	-	-	-	-	-	-	-

FOOTNOTES FOR WEATHER PHENOMENA MATRIX FOR NWS-PREPARED TERMINAL FORECASTS

- 1 - Only one descriptor shall be included for each weather phenomena group, e.g., BCFG.
- 2 - In NWS-prepared terminal forecasts, vicinity is defined as 5SM to 10SM from the center of the runway complex of an airport. In NWS-prepared terminal forecasts, vicinity shall be combined only with fog (VCFG), showers (VCSH), or thunderstorms (VCTS), and only when forecasting prevailing conditions (i.e., initial time period, FM or BECMG groups).
- 3 - Raised by wind to less than 6 feet above the ground.
- 4 - TS may be forecast by itself if no precipitation is associated with the thunderstorm.
- 5 - No intensity is ever given to hail (GR/GS [snow pellets]) or ice crystals (IC).
- 6 - Largest forecast hailstone has a diameter of 1/4 inch or more.
- 7 - Forecast hailstone diameter is less than 1/4 inch.
- 8 - VCTS is a valid combination for all airports for which NWS offices prepare terminal forecasts. [In the METAR code, VCTS shall only be reported by automated stations.]
- 9 - In NWS-prepared terminal forecasts, VCSH shall be used to forecast showers 5-10SM from the airport. [In the METAR code, VCSH shall be used to report any type of precipitation not at point of observation, but > 0 to 10SM.] The type and intensity of showers in the vicinity shall not be specified, i.e., +VCSHRA is not allowed.
- 10 - BR (mist) shall only be used when the visibility is forecast to be at least 5/8SM, but not more than 6SM.
- 11 - For FG (fog) to be forecast with any qualifiers **except** VC¹², MI¹³, PR¹⁴, or BC¹⁵, the visibility shall be < 5/8SM.
- 12 - VCFG is used to forecast fog at any visibility between 0 and 6SM in the vicinity (5 - 10SM) of the airport.
- 13 - For MIFG (shallow fog) to be forecast, the visibility at 6 feet above ground level shall be 5/8SM or more and the apparent visibility in the fog layer shall be expected to be less than 5/8SM.
- 14 - PRFG (partial fog) indicates that a substantial part of the airport is forecast to be covered by fog (visibility <5/8SM) while the remainder of the airport is expected to be clear of fog.
- 15 - BCFG (patches fog) indicates that patches of fog (visibility <5/8SM) are forecast to randomly cover the airport.
- 16 - FZFG is fog (**visibility < 5/8SM**) consisting predominately of water droplets at temperatures **below** 0°C, whether or not the fog is expected to deposit rime ice.
- 17 - Volcanic Ash (VA) is always included in the forecast when expected. Visibility is not a factor.
- 18 - SN BLSN indicates snow falling from clouds with blowing snow occurring.
- 19 - SQ (squall) is a sudden increase in wind speed of at least 16 knots, the speed rising to 22 knots or more and lasting for at least one minute.
- 20 - Generally, Funnel Clouds should not be forecast in terminal forecasts.
- 21 - Generally, Tornadoes and Waterspouts should not be forecast in terminal forecasts.
- 22 - SS is forecast if visibility is \$ 5/16SM and # 5/8SM. Forecast +SS if visibility is expected to be < 5/16SM.
- 23 - DS is forecast if visibility is \$ 5/16SM and # 5/8SM. Forecast +DS if visibility is expected to be < 5/16SM.

In the terminal forecast, no more than 3 significant weather groups shall be used to forecast weather phenomena at or near the airport. If more than one significant weather phenomena is required in the forecast, separate weather groups shall be included. If more than one form of precipitation is forecast, the appropriate contractions shall be combined in a single group with the predominant type of precipitation included first. In such a single precipitation group, the intensity shall refer to the total precipitation and be encoded with one or no indicator as

appropriate, e.g., -RASN FG HZ.

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